

Epidemiology and Health Policy: Some Historical Highlights

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EPIDEMIOLOGY, AS A METHODOLOGY and as a body of knowledge, was developed in response to the community's or society's concerns with health problems, particularly to epidemics. It is possible to trace the roots of epidemiologic concepts to biblical and classical times, threading through the Middle Ages and the Renaissance. However, the major formative period for the epidemiologic and public health movement was the 19th century, although it overlaps somewhat with the latter part of the 18th century. I will therefore limit the historical frame of reference to this era. However, it should be recognized that patterns established within this period continued throughout the 20th century into contemporary time.

These patterns of the relationships between epidemiology and health policy are varied and rich; they have many interesting and relevant facets. It is necessary to limit this discussion to a picture painted in broad strokes, emphasizing the highlights. Because of constraints, this review will also be limited to events that occurred mainly in England and the United States, since they form a direct path to the contemporary scene. The concepts that were worked out represent the basis for developments beyond the boundaries of these two countries.

18th Century Pioneers

It is notable that, as far back as the 18th century, epidemiologic knowledge was already used as a basis for health policy. I would like to cite two examples. Toward the end of the 18th century, John Haygarth in Chester, England, analyzed the distribution of secondary cases of various infectious diseases within households, from which he inferred that different diseases, such as measles, scarlet fever, chincough, or whooping cough, had different incubation or "latent" periods (*1*). From this observation, Haygarth inferred that:

"If a regulation could be universally adopted of immediately removing out of the family such of the poor people as are seized with fevers, it is evident that the most salutary consequences would follow. Reasonable objections might be made to receiv-

ing such patients into the general infirmary, even into separate wards, lest the infection should spread through the whole house, . . . But might not this and every other objection be obviated by erecting, on the ground which adjoins, and belongs to the Infirmary, a building to be divided into spacious airy, separate apartments, where patients affected with fever and properly recommended might be received on any day of the week?

Although this idea was first proposed in 1774, it was not until 1783 that Haygarth was able to institute a "fever ward" in the attic of the infirmary. Because of the success of the Chester "fever wards," similar ones were established in Manchester, Liverpool, and other cities. These obviously provided the rationale for the development of contagious diseases hospitals, a policy that continued until the middle of the 20th century in many countries, including the United States.

This policy of isolating persons with communicable diseases within a city reflected the more general practice of quarantine on a national basis, which has a lengthy history and was based on the general observation that certain diseases such as plague and leprosy were contagious. However, the more specific institution of fever wards was based on epidemiologic observations. Haygarth also became involved in issues concerning smallpox inoculation, organizing a Smallpox Society and elaborating a "Sketch of a Plan to Exterminate the Casual Smallpox from Great Britain and to Introduce General Inoculation," which was published in 1793 (*1*). After Jenner showed the efficacy of vaccination, Haygarth became its advocate. He stated:

The discovery of Vaccine Inoculation by Dr. Jenner is the most fortunate and beneficial improvement that medical science ever accomplished. It does not however, preclude the necessity of investigating the variolous poison, and of considering by what regulations its propagation may be prevented.

During the 18th century there were several others in England who used what actually were epidemiologic approaches to disease problems which were then adapted to become the basis of health policy. This course of events was particularly true in both the Army and Navy. Outstanding in this group of advocates was James Lind,

'An improvement in the treatment of disease, and any addition to medical science, will tend ultimately to the diminution of human suffering; but the registration of the causes of death is calculated to exercise a still more direct influence upon public health. Diseases are more easily prevented than cured, and the first step to their prevention is the discovery of their exciting causes.'

who had developed certain hypotheses from epidemiologic observations on the etiology and treatment of scurvy. He evaluated these hypotheses in a clinical trial in 1747 in the following way (2):

On the 20th of May, 1747, I took twelve patients in the scurvy, on board the SALISBURY at sea. Their cases were as similar as I could have them. They all in general had putrid gums, the spots and lassitude, with weakness of their knees. They lay together in one place, being a proper apartment for the sick in the forehold; and had one diet common to all . . . Two of these were ordered each a quart of cyder a day. Two others took twenty-five gutts of elixir vitriol three times a day. Two others took two spoonsful of vinegar three times a day . . . Two of the worst patients . . . were put under a course of sea water . . . Two others had each two oranges and one lemon given them every day. These they eat with greediness, at different times, upon an empty stomach. They continued but six days under this course, having consumed the quantity that could be spared. The two remaining patients took the bigness of a nutmeg three times a day, of an electuary recommended by a hospital-surgeon . . . The consequence was, that the most sudden and visible good effects were perceived from the use of the oranges and lemons; one of these who had taken them being at the end of six days fit for duty. The spots were not indeed at that time quite off his body, nor his gums sound; but without any other medicine, than a gargarism of elixir vitriol, he became quite healthy before we came into Plymouth, which was on the 16th of June. The other was the best recovered of any in his condition; and being now deemed pretty well, was appointed to nurse to the rest of the sick.

From these, Lind inferred that citric acid fruits cured scurvy and would also serve as a method of prevention. The British Navy eventually instituted the policy of including limes or lime juice in the diet on ships in 1795. These specific examples illustrate the use of epidemiologic data in inferring a mode of transmission of disease and of a specific etiologic factor of disease as a basis for instituting rather specific health policies.

This transfer of epidemiologic data to policy was practiced more extensively during the 19th century, when the philosophy, concepts, and methods of epidemiology were being developed in conjunction with the evolution of the public health movement. These developments should be viewed within the social and economic context of English life. Practitioners of scientific disciplines all too often forget the social factors that have played a role in the development of their discipline. In the early 19th century, there was increased migration to the cities, increased urbanization, crowding, inadequate housing, and filthy living conditions among the urbanized poor, who represented an extremely large proportion of the population. It was noted that mortality rates in urban areas were higher than in rural areas. Upon these conditions were superimposed the epidemics of cholera of 1831–32, 1848–49 and 1854–55, which took a greater toll of those in the lower social classes than other segments of the populace. In addition, typhus, typhoid fever, and tuberculosis were endemic, and death rates from these diseases were selectively higher among the lower than the higher classes.

Three 19th Century Epidemiologists

To illustrate the interrelationship of epidemiology and health policy in the 19th century, I have selected the work of three men whose contributions provided at least a part, albeit a major part, of the basis for the contemporary public health program.

At first, there was Edwin Chadwick, who after 3 years of detailed investigation, presented to Parliament in 1842 a "Report on the Sanitary Conditions of the Laboring Population of Great Britain," which represented the statement of the Sanitary, Hygienic, or Public Health Movement, whichever term one prefers (3). The report emphasized the relationship between high mortality and such environmental conditions as poor sanitation, an inadequate and polluted water supply, and overcrowding.

Vital statistics data in the form of mortality rates were integrated with whatever morbidity information was available and could be used to present the case for disease prevention. In the summary which introduced the report, Chadwick stated (3):

The registered mortality from all specified diseases in England and Wales was, during the year 1838, 282,940, or 18 per thousand of the population. These deaths are exclusive of the deaths from old age, which amounted to 35,564, and the deaths from violence, which amounted to 12,055. The deaths from causes not specified were 11,970. The total amount of deaths was 342,529 for that year . . . The annual slaughter in England and Wales from preventable causes of typhus which attacks persons in the vigour of life, appears to be double the amount of what was suffered by the Allied Armies in the battle of Waterloo. It will be shown that diseases such as those which now

prevail on land, did within the experience of persons still living, formerly prevail to a greater extent at sea, and have since been prevented by sanitary regulations; and that when they did so prevail in ships of war, the deaths from them were more than double in amount of the deaths in battle. But the number of persons who die is to be taken also as the indication of the much greater number of persons who fall sick, and who, although they escape are subjected to the suffering and loss occasioned by attacks of disease.

The report contains a section on "Comparative Chances of Life in Different Classes," which is replete with tables on proportional mortality in different areas of the country and mean ages of death in different social classes. One particular statistic is worth repeating: "More than half the children of the working classes die and only $\frac{1}{5}$ of the children of the gentry die before the fifth year of age."

The purpose of Chadwick's analysis was to affect health policy, which the report considered directly, as shown by the following title of a chapter: "Recognized Principles of Legislation and State of the Existing Law for the Protection of the Public Health." Although the report did not contain specific recommendations for legislation, it did lead to the formation of the Health of Towns Commission and finally to the Public Health Act of 1848, which established a General Board of Health at a national level. Chadwick's sanitary report should be viewed as an amalgam of epidemiologic data with social and moral philosophy which had one essential policy objective, namely, the establishment of the principle that the national government had a responsibility for the health of the public.

The Public Health Act of 1848 resulted in the appointment of John Simon as Medical Officer of Health for the City of London. In 1855, he became the Medical Officer to the General Board of Health and in 1858 to the Privy Council, when the public health responsibility of the General Board of Health was transferred to the Council. The latter two appointments were at a national level. The Privy Council was required "to cause to be made such inquiries as they (their Lordships) see fit in relation to any matters concerning the Public Health in any place or places . . ." The Medical Officer had to "report to their Lordships . . . in relation to any matters concerning the Public Health, or such matters as may be referred to him for that purpose." (4) John Simon gathered around him a team of physicians who over a period of years conducted field investigations along a broad spectrum of public health problems, including investigations of epidemics, habitual predominance of certain diseases or groups of diseases in particular districts of England, excessive fatality of pulmonary diseases in populations having special industries, infant mortality in certain areas, and determining the elementary requisites for population

healthiness with regard to food supply, housing, and industrial circumstances. Such inquiries essentially consisted of mortality analyses and field epidemiologic investigations. It may well be regarded as the grandfather of today's Epidemic Intelligence Service of the Centers of Disease Control.

To what did all this activity lead? As Simon himself states: "The appeal was not in vain. Our exposure of so much gross insufficiency in the laws which purported to protect the public health was speedily followed by legislation of the highest practical importance."

The legislation stimulated by these reports was considerable. Thus, there was a direct relationship between what would be termed "epidemiology" and "health policy," the latter in the form of health legislation. This was done methodically with intent, as indicated by the following quotation (4):

We had to invoke, for our special province of duty, the spirit which for many previous years had been tending to more and more activity in other departments of medicine, as indeed generally throughout the biological and physical sciences: we had to aim at stamping on public hygiene a character of greater exactitude than it had hitherto had. Confident that, if the knowledge were got, its utilization would speedily follow, we had to endeavor that all considerable phenomena of disease-prevalence in the country should be seen and measured and understood with precision—should be seen as exact quantities, be measured without fallacious admixture, be understood in respect of their causes and modes of origin; that true facts, and true interpretation of facts, with regard to the diseases of the country, and the causes producing them, should be supplied on a sufficiently large scale for political appreciation and use.

Spanning the careers of both Chadwick and Simon was that of William Farr, the father of vital statistics. To Farr belongs the credit for developing an organized national vital statistics system which was the model eventually adopted throughout the world. Farr's contributions were not limited to vital statistics; he developed and utilized epidemiologic concepts and methods, which have been discussed elsewhere, and are still part of the epidemiologist's armamentarium (5). He was clearly allied with and very active in the public health movement in England. Throughout his work, there is the recurring theme of the usefulness of vital statistics and epidemiology as a basis of social policy. This is exemplified, in a general way, in his report to the International Statistics Congress in 1855 on the "Objects of the Record and Tabulation of the Diseases of Mankind," in which he suggested a classification of causes of death. He introduced his report as follows (6):

The state of health among the people differs in different times and in different places; and the principal purpose of the registration of diseases is to determine the degree of variation in

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each district, and each class of the population, as well as the extent to which they are modified by circumstances.

The causes of insalubrity are thus discovered at their source by death itself; and it is found that in many instances these causes admit of removal by sanitary measures.

In his first report to the Registrar General in 1839, he stated (6):

An improvement in the treatment of disease, and any addition to medical science, will tend ultimately to the diminution of human suffering; but the registration of the causes of death is calculated to exercise a still more direct influence upon public health. Diseases are more easily prevented than cured, and the first step to their prevention is the discovery of their exciting causes. The Registry will show the agency of these causes by numerical facts, and measure the intensity of their influence . . . In exhibiting the high mortality, the diseases by which it is occasioned, and the exciting causes of the disease, the abstract of the registers will prove, that while a part of the sickness is inevitable, and a part can only be expected to disappear before progressive social amelioration, a considerable proportion of the sickness and deaths may be suppressed by the general adoption of hygienic measures which are in actual but partial operation. It may be affirmed, without great risk of exaggeration, that it is possible to reduce the annual deaths in England and Wales by 30,000, and to increase the vigour (may I not add the industry and wealth?) of the population in equal proportion for diseases are the iron index of misery, which recedes before strength, health, and happiness as the mortality declines.

Early in his career, Farr utilized statistical and epidemiologic methods in an attempt to determine what policy should be used for the care of the insane. Should they be hospitalized in asylums or should they be taken care of in licensed smaller institutions? He also actively proposed government-sponsored life insurance and health insurance programs for the working classes, as indicated by the following (6):

Health insurance may be effected on the same convenient plan for servants and citizens as life insurance . . . clerks,

artizans, and all the laboring classes obtain salaries and wage-incomes much earlier in life than the higher professional classes, and it is a fortunate circumstance of which they are apparently unaware that by setting aside every year a small sum for the 8 or 10 years after their earnings commence, they can insure their lives, purchase a pension in old age, and insure a provision in sickness before they are married and thus leave the whole of their income after marriage free to meet the increased expenses of housekeeping.

The developments in Britain were paralleled by similar ones in other countries in Europe and in the United States, in varying degrees. To show the similarities, it is necessary to mention Griscom's "The Sanitary Conditions of the Laboring Population of New York," published in 1848 and Shattuck's "Report of a General Plan for the Promotion of Public and Personal Health," which was based on a survey of health conditions in Massachusetts and appeared in 1850 (7,8). Similar surveys were conducted in several other countries, and epidemiology served as the basis for such activities.

Health policy and public health programs have been, to a considerable extent, determined by the scientific knowledge of the times. Thus, towards the end of the 19th century, the developments stimulated by the germ theory of disease provided a rational basis for health policy concerning the infectious diseases that were the major causes of morbidity and mortality at the time. Epidemiologists contributed to these advances and then utilized them further for establishing health policy. In fact, for more than 50 years until the middle of the 20th century, it was customary in the United States for epidemiologists to become health policy makers and public health administrators in both governmental and non-governmental organizations.

Frost's Role in Epidemiology

During the first half of the 20th century, a number of public health workers in the United States used epidemiologic methods, or data, or both, to provide a scientific epidemiologic basis for health policy, including such eminent persons as Haven Emerson, Charles V. Chapin, Edgar Sydenstricker, Wade Hampton Frost, and Gaylord Anderson. Their contributions are well known. However, I think it would be worthwhile to show how an outstanding epidemiologist—Wade Hampton Frost—regarded the relationship between epidemiology and public health work. He organized the first academic department of epidemiology in an educational institution in the world and made the first attempt to systematize epidemiology in terms of its philosophy and concepts.

Frost is best known for his contributions to epidemiologic methods (9). It has been pointed out only recently that Frost had a very broad view of the important

role of epidemiology within public health. I would like to quote from his paper entitled "The Importance of Epidemiology as a Function of Health Departments," which was published in 1923 (10). At that time most public health work and epidemiologic studies were concerned with infectious diseases, but his comments are relevant to the contemporary public health and epidemiologic scene and have a very modern flavor. He stated:

Nevertheless, it seems fair to say that our knowledge of infectious disease has become somewhat unbalanced, relatively more complete on the experimental than the epidemiological side; and that there is urgent need at present to build up the more detailed epidemiological knowledge which is necessary to make the experimentally established principles more directly applicable to practical prevention.

And,

But, any modification of the conditions of life as they exist in a community, whether by the establishment of public works or public service, by restraint of the individual, or by changing fixed personal habits, is a serious matter, necessarily more or less costly in money or effort, and not to be undertaken without due cause and some warrant of benefit proportionate to the sacrifice. This requires something more than a knowledge of the specific organisms of disease, in terms of their reactions under the controlled conditions of the laboratory. It equally requires a knowledge of the community, of the psychology of the people, their social organization, the conditions and events of their everyday life. It requires that the knowledge of fundamental causes of disease be fitted together with the knowledge of people into a practical epidemiology, directly applicable to prevention.

Furthermore,

And, although this discussion is limited to infectious diseases, the health officers' problems are not so limited, and there is equal need for the same kind of study of occupational, nutritional and organic diseases.

The further work which needs to be done in epidemiology is:

1. The extension of experimental investigation, the exact limits and potentialities of which cannot be foreseen.
2. The extension and improvement of broad statistics of morbidity and mortality . . .
3. A more systematic, detailed and critical study of the relation of morbidity and mortality not to the broad conditions, but to the intimate details of the community, domestic and individual life . . .

As the major epidemics of infectious diseases were conquered, the morbidity and mortality picture gradually changed, leading to a change in the forms of health policy. Diseases such as cancer, heart disease, and other so-called chronic diseases assumed prominence. The ap-

plication of epidemiologic methods to these areas of current concern clearly reflects the extension of Frost's thought into these newer health problems.

The important objective of reviewing the historical background is to emphasize the fact that, since its inception, epidemiology has been closely linked with the public health movement and, therefore, with health policy. Study of the evolution of the public health movement has indicated that its roots must be firmly implanted in an epidemiologic base. In the past 30 years or so, there has been a general tendency for epidemiology to ignore its natural and historical relationship with public health, and much health policy has tended to ignore the need for epidemiologic consideration. It is clear from excursions in the historical evolution of both of these movements that, in order to continue with their past successes, they must constantly be nourished by each other. It is unfortunate that we must be constantly reminded of their necessary interrelationship.

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